Scientific Name: *Cylindrospermopsis raciborskii* (Wołoszyńska, 1912), Seenayya and Subba Raju, 1972

Common Name: Cylindro

Taxonomy: Available through ITIS

Identification: This species of cyanobacterium (blue-green alga) is composed of trichomes (chained filaments) that are solitary and straight. In Mona Lake, Lake Michigan basin, their tube-shaped cells contain groups of scattered gas vesicles and are divided by barely visible walls (Hong et al. 2006). In other populations, such as in Lake Constance near Ottawa, Ontario, the cell walls are thick and conspicuous (Hamilton et al. 2005). The terminal cells may differentiate into cone-shaped heterocysts. Akinetes (thick-walled spore-like structures) are cylindrical to oval-shaped, found singly or in pairs, near the terminal heterocysts (Hong et al. 2006). Both straight and coiled trichomes of this species exist in different locations around the world. Morphological variation in trichomes, vegetative cells and heterocysts can occur even among very similar genetic isolates of *C. raciborskii*, depending on abiotic conditions (Saker et al. 1999a; Saker and Neilan 2001; Shafik et al. 2003).

Size: In Mona Lake, trichomes range from 51–311 μm in length and 1.7 – 4.2 μm in width, heterocysts are 5–11 μm by 2–5 μm, and akinetes are 8–16 μm by 2–5 μm (Hong et al. 2006).

Native Range: The genus *Cylindrospermopsis* is regarded as tropical/subtropical in origin, but it has expanded into temperate areas, particularly the northern hemisphere. The strain of *C. raciborskii* introduced to the Great Lakes may have originated in South America.

Nonindigenous Occurrences: *C. raciborskii* was recorded from Mona Lake in 2002 and 2003 as well as Muskegon Lake in 2005, both of which are in the Lake Michigan basin (Hong et al. 2006). This species was also recorded from Lake Erie recently (Conroy et al. 2006). There is one possible record of this species in Lake Erie from 1971 (Taft and Taft 1971) which may have been previously misidentified as *Anabaenopsis raciborskii* (Kling 2004).

Means of Introduction: Potential modes of introduction of this species to the Lake Michigan watershed include shipping, recreational boating, waterfowl and/or wind dispersal (Hong et al. 2006).

Status: Established.

Ecology: The akinetes of *C. raciborskii* may persist as spores in the sediments for long periods of time. Akinete formation may be triggered by cold temperatures or large temperature fluctuations and requires high levels of reactive phosphorus (Moore et al. 2003; Moore et al. 2005). Germination occurs more or less synchronously in response to

water temperature rising to 22–24ºC in temperate regions (Padisak 2003; Hong et al. 2006). Akinetes are probably necessary to stimulate a new season's growth, providing the initial bloom with concentrated phosphorus. Upon germination, akinetes elongate, split open, and the germling cells that emerge will eventually become trichomes (Moore et al. 2004). Algae blooms consist of trichomes found in and below the euphotic zone, not at the surface (Saker and Griffiths 2001). In tropical or subtropical waters, *C. raciborskii* is perennial and akinetes rarely develop (Padisak 2003).

Concentrations of this species in Mona and Muskegon Lakes have remained low during late summer sampling, accounting for 6% of phytoplankton count in 2002 and 2003 in the former and <1% in 2005 in the latter, possibly due to temperature limitations (Hong et al. 2006). In Constance Lake, Ontario, *C. raciborskii* blooms appear to be controlled by water temperature and not nutrients (Hamilton et al. 2005).

C. raciborskii can reach very high concentrations (e.g. 176 000 units ml^{-1} in Newnans Lake, Florida) (Chapman and Schelske 1997). It is capable of fixing atmospheric nitrogen in its heterocysts in response to low cell nitrogen concentration, as well as taking up phosphorus at low concentrations (Shafik et al. 2001; Sprober et al. 2003). The relatively high phosphorus uptake affinity and storage capacity confer *C. raciborskii* a competitive advantage both in deep lakes with nutrient stratification and in lakes with no such nutrient gradation (Istvanovics et al. 2000). Moreover, this species may also compete well for light in destratified lakes (Antenucci et al. 2005) and artificially mixed reservoirs (Burford et al. 2006).

Conditions that are often associated with blooms of *C. raciborskii* include: low flow; low water level; low nitrogen to phosphorus ratio; high water temperature; stable thermal stratification; increased retention time; high pH; high sulfate concentration; anoxia in at least some strata; high turbidity; high incident irradiation; and low macrophyte biomass (Ramberg 1987; Bowling 1994; Fabbro and Duivenvoorden 1996; Mayer et al. 1997; McGregor and Fabbro 2000; Saker and Neilan 2001; da Silva et al. 2001; Briand et al. 2002; Bouvy et al. 1999; Tucci and Sant'Anna 2003; Chellappa and Costa 2003; Bormans et al. 2004; Bouvy et al. 2006; Berger et al. 2006; Hong et al. 2006). The optimum temperature for growth is 25–30ºC, although growth can occur between 15ºC and 35ºC, depending on the strain. The optimum light intensity for growth is 80–121 μmol m^{-2} s^{-1}, but growth occurs at levels as low as 22 μmol m^{-2} s^{-1} (Chonudomkul et al. 2004; Briand et al. 2004; Saker and Griffiths 2000; Shafik et al. 2001). The maximum salinity tolerance is 4 g L^{-1} NaCl (Moisander et al. 2002).

Some strains of this species are capable of producing cylindrospermopsin, a toxic compound that affects the human liver and kidneys, as well as anatoxin-a and saxitoxin, which both act as paralytic shellfish neurotoxins (Schembri et al. 2001). Increased production of cylindrospermopsin is associated with long periods of growth in high light intensity conditions (Dyble et al. 2006), in the presence of a fixed nitrogen source (Saker and Neilan 2001), and at lower water temperatures (Saker and Griffiths 2000).

Impact of Introduction

A) Realized: To date there are no recorded impacts associated with the presence of this species in the Great Lakes basin.

B) Potential: Cylindrospermopsin from toxic *C. raciborskii* strains has caused liver damage and even death in humans, when the species occurs in water supply systems (Bernard et al. 2003; Falconer and Humpage 2006; Hawkins et al. 1985). Cylindrospermopsin also has the potential to be genotoxic or carcinogenic in humans and to cause acute skin reactions in people on contact (Falconer and Humpage 2001; Falconer and Humpage 2006; Humpage et al. 2000; Shen et al. 2002; Stewart et al. 2006).

This species may have been responsible for fish kills in a reservoir in Brazil (De Souza et al. 1998). A toxic strain is also assumed responsible for cattle deaths in Australia (Saker et al. 1999b; Thomas et al. 1998). In the St. Johns River System, Florida, this cyanobacterium appears to reduce the size and diversity of zooplankton, possibly because nutrients are sequestered or unavailable to grazers in the water column (Leonard and Paerl 2005). Some rotifers and cladocerans exhibit reduced feeding rates, growth rates or growth potential in the presence of *C. raciborskii* (Hawkins and Lampert 1989; Rothhaupt 1991; Nogueira et al. 2004). *C. raciborskii* may also cause phytoplankton diversity to decrease, as has been observed in Lake Jesup, Florida (Dobberfuhl 2003) and a pond in Hungary (Borics et al. 2000). Moreover, cylindrospermopsin is known to bioaccumulate in molluscs and crayfish (White et al. 2006; Saker et al. 2004; Saker and Eaglesham 1999) and is toxic to some of these invertebrates (Metcalf et al. 2002). Anatoxin produced by some strains of *C. raciborskii* has been found to affect snails (Kiss et al. 2002).

By contrast, some rotifers can apparently graze on straight, but not coiled, trichomes of this cyanobacterium (Fabbro and Duivenvoorden 1996), while other rotifers and copepods may cut up filaments to make them edible in size to the entire zooplankton assemblage present (Bouvy et al. 2001).

Remarks: Climate change may be contributing to the expansion of this species in temperate latitudes (Briand et al. 2004; Hamilton et al. 2005). Genetic similarities exist between strains of *C. raciborskii* from Australia and Europe, Africa and Australia, and North and South America (Dyble et al. 2002; Gugger et al. 2005). The relatively recent colonization of northerly latitudes in North America, including the Great Lakes, probably involves populations originally from South America (Gugger et al. 2005).

Voucher Specimens:

References:

Antenucci, J. P., A. Ghadouani, M. A. Burford and J. R. Romero. 2005. The long-term effect of artificial destratification on phytoplankton species composition in a subtropical reservoir. Freshwater Biology 50(6):1081-1093.

Berger, C., N. Ba, M. Gugger, M. Bouvy, F. Rusconi, A. Coute, M. Troussellier and C. Bernard. 2006. Seasonal dynamics and toxicity of *Cylindrospermopsis raciborskii* in Lake Guiers (Senegal, West Africa). FEMS Microbiology Ecology 57(3):355-366.

Bernard, C., M. Harvey, J. F. Briand, R. Bire, S. Krys and J. J. Fontaine. 2003. Toxicological comparison of diverse *Cylindrospermopsis raciborskii* strains: evidence of

liver damage caused by French *C. raciborskii* strain. Environmental Toxicology 18(3):176-186.

Borics, G., I. Grigorszky, S. Szabo and J. Padisak. 2000. Phytoplankton associations in a small hypertrophic fishpond in East Hungary during a change from bottom-up to top-down control. Hydrobiologia 424(1-3):79-90.

Bormans, M., P. W. Ford, L. Fabbro and G. Hancock. 2004. Onset and persistence of cyanobacterial blooms in a large impounded tropical river, Australia. Marine and Freshwater Research 55(1):1-15.

Bouvy, M., M. Pagano and M. Troussellier. 2001. Effects of a cyanobacterial bloom (*Cylindrospermopsis raciborskii*) on bacteria and zooplankton communities in Ingazeira reservoir (northeast Brazil). Aquatic Microbial Ecology 25:215-227.

Bouvy, M., N. Ba, S. Ka, S. Sane, M. Pagano and R. Arfi. 2006. Phytoplankton community structure and species assemblage succession in a shallow tropical lake (Lake Guiers, Senegal). Aquatic Microbial Ecology 45(2):147-161.

Bouvy, M., R. Molica, S. De Oliveira, M. Marinho, B. Beker. 1999. Dynamics of a toxic cyanobacterial bloom (*Cylindrospermopsis raciborskii*) in a shallow reservoir in the semi-arid region of northeast Brazil. Aquatic Microbial Ecology 20(3):285-297.

Bowling, L. 1994. Occurrence and possible causes of a severe cyanobacterial bloom in Lake Cargelligo, New South Wales. Australian Journal of Marine and Freshwater Research 45(5):737-745.

Briand, J.-F., C. Leboulanger, J.-F. Humbert, C. Bernard and P. Dufour. 2004. *Cylindrospermopsis raciborskii* (Cyanobacteria) invasion at mid-latitudes: selection, wide physiological tolerance, or global warming? Journal of Phycology 40(2):231-238.

Briand, J. F., C. Robillot, C. Quiblier-Lloberas, J. F. Hubert, A. Coute and C. Bernard. 2002. Environmental context of *Cylindrospermopsis raciborskii* (Cyanobacteria) blooms in a shallow pond in France. Water Research 36(13):3183-3192.

Burford, M. A., K. L. McNeale and F. J. McKenzie-Smith. 2006. The role of nitrogen in promoting the toxic cyanophyte *Cylindrospermopsis raciborskii* in a subtropical water reservoir. Freshwater Biology 51(11):2143-2153.

Chapman, A. D. and C. L. Schelske. 1997. Recent appearance of *Cylindrospermopsis* (Cyanobacteria) in five hypereutrophic Florida lakes. Journal of Phycology 33:191-195.

Chellappa, N. T. and M. A. M. Costa. 2003. Dominant and co-existing species of Cyanobacteria from a eutrophied reservoir of Rio Grande do Norte State, Brazil. Acta Oecologica 24(suppl. 1):S3-S10.

Chonudomkul, D., W. Yongmanitchal, G. Theeragool, M. Kawachi, F. Kasal, K. Kaya and M. Watanabe. 2004. Morphology, genetic diversity, temperature tolerance and toxicity of *Cylindrospermopsis raciborskii* (Nostocales, Cyanobacteria) strains from Thailand and Japan. FEMS Microbiology Ecology 48(3):345-355.

Conroy, J. D., D. D. Kane, E. L. Quinlan and D. A. Culver. 2006. Seeing is believing – synergy amongst Lake Erie plankton and nutrients, exotic species, and climate change. The Fourth Biennial Conference of the Lake Erie Millennium Network – 28 February 2006.

da Silva, C. A., S. Train and L. c. Rodrigues. 2001. Structure and dynamics of the phytoplankton community downstream and upstream Corumba reservoir, Caldas Novas, state of Goias, Brazil. Acta Scientiarum Universidade Estadual de Maringa 23(2):283-290.

De Souza, R. C. R., M. C. Carvalho and A. C. Truzzi. 1998. *Cylindrospermopsis raciborskii* (Wołosz.) Seenaya and Subba Raju (Cyanophyceae) dominance and a contribution to the knowledge of Rio Pequeno arm, Billings Reservoir, Brazil. Environmental Toxicology and Water Quality 13(1):73-81.

Dobberfuhl, D. R. 2003. *Cylindrospermopsis raciborskii* in three central Florida lakes: population dynamics, controls and management implications. Lake and Reservoir Management 19(4):341-348.

Dyble, J., H. W. Paerl and B. A. Neilan. 2002. Genetic characterization of *Cylindrospermopsis raciborskii* (Cyanobacteria) isolated from diverse geographic origins based on *nifH* and *cpcBA*-IGS nucleotide sequence analysis. Applied and Environmental Microbiology 68(5):2567-2571.

Dyble, J., P. A. Tester and R. W. Litaker. 2006. Effects of light intensity on cylindrospermopsin production in the cyanobacterial HAB species *Cylindrospermopsis raciborskii*. African Journal of Marine Science 28(2):309-312.

Fabbro, L. D. and L. J. Duivenvoorden. 1996. Profile of a bloom of the cyanobacterium *Cylindrospermopsis raciborskii* (Woloszynska) Seenaya and Subba Raju in the Fitzroy River in tropical central Queensland. Marine and Freshwater Research 47:685-694.

Falconer, I. R. and A. R. Humpage. 2001. Preliminary evidence for in vivo tumour initiation by oral administration of extracts of the blue-green alga *Cylindrospermopsis raciborskii* containing the toxin cylindrospermopsin. Environmental Toxicology 16(2):192-195.

Falconer, I. R. and A. R. Humpage. 2006. Cyanobacterial (blue-green algal) toxins in water supplies: *Cylindrospermopsis*. Environmental Toxicology 21(4, Sp. Iss. SI):299-304.

Gugger, M., R. Molica, B. Le Berre, P. Dufour, C. Bernard and J.-F. Humbert. 2005. Genetic diversity of *Cylindrospermopsis* strains (Cyanobacteria) isolated from four continents. Applied and Environmental Microbiology 71(2):1097-1100.

Hamilton, P. B., L. M. Ley, S. Dean and F. R. Pick. 2005. The occurrence of the cyanobacterium *Cylindrospermopsis raciborskii* in Constance Lake: an exotic cyanoprokaryote new to Canada. Phycologia 44(1):17-25.

Hawkins, P. R., M. T. C. Runnegar, A. R. B. Jackson and I. R. Falconer. 1985. Severe hepatotoxicity caused by the tropical cyanobacterium (blue-green alga) *Cylindrospermopsis raciborskii* (Wołoszyńska) Seenaya and Subba Raju isolated from a domestic water supply reservoir. Applied and Environmental Microbiology:1292-1295.

Hawkins, P. R. and W. Lampert. 1989. The effect of *Daphnia* body size on filtering rate inhibition in the presence of a filamentous cyanobacterium. Limnology and Oceanography 34(6):1084-1089.

Hong, Y., A. Steinman, B. Biddanda, R. Rediske and G. Fahnenstiel. 2006. Occurrence of the toxin-producing cyanobacterium *Cylindrospermopsis raciborskii* in Mona and Muskegon Lakes, Michigan. Journal of Great Lakes Research 32:645-652.

Humpage, A. R., M. Fenech, P. Thomas and I. R. Falconer. 2000. Micronucleus induction and chromosome loss in transformed human white cells indicate clastogenic and aneugenic action of the cyanobacterial toxin, cylindrospermopsin. Mutation Research 472(1-2):155-161.

Istvanovics, V., H. M. Shafik, M. Presing and S. Juhos. 2000. Growth and phosphate uptake kinetics of the cyanobacterium, *Cylindrospermopsis raciborskii* (Cyanophyceae) in throughflow cultures. Freshwater Biology 43(2):257-275.

Kiss, T., A. Vehovszky, L. Hiripi, A. Kovacs and L. Voros. 2002. Membrane effects of toxins isolated from a cyanobacterium, *Cylindrospermopsin raciborskii*, on identified molluscan neurons. Comparative Biochemistry and Physiology Part C Toxicology and Pharmacology 131C(2):167-176.

Kling, H. J. 2004. *Cylindrospermopsis raciborskii* (Woloszynska) Seenayya and Subba Raju: a brief historic overview and recent discovery in the Assiniboine River. Algal Taxonomy and Ecology Inc., Winnipeg, Manitoba. <http://members.shaw.ca/gregmccullough/CylindRaciborskii2B.htm> Revision Date: 09-10/2004

Leonard, J. A. and H. W. Paerl. 2005. Zooplankton community structure, micro-zooplankton grazing impact, and seston energy content in the St. Johns river system, Florida as influenced by the toxic cyanobacterium *Cylindrospermopsis raciborskii*. Hydrobiologia 537:89-97.

Mayer, J., M. T. Dokulil, M. Salbrechter, M. Berger, T. Posch, G. Pfister, A. K. T. Kirschner, B. Velimirov, A. Steitz and T. Ulbricht. 1997. Seasonal successions and trophic relations between phytoplankton, zooplankton, ciliate and bacteria in a hypertrophic shallow lake in Vienna, Austria. Hydrobiologia 342-343(0):165-174.

Metcalf, J. S., K. A. Beattie, S. Birmingham, M. L. Saker, A. K. Torokne and G. A. Codd. 2002. Toxicity of cylindrospermopsin to the brine shrimp *Artemia salina*: comparisons with protein synthesis inhibitors and microcystins. Toxicon 40(8):1115-1120.

McGregor, G. B. and L. D. Fabbro. 2000. Dominance of *Cylindrospermopsis raciborskii* (Nostocales, Cyanoprokaryota) in Queensland tropical and subtropical reservoirs: implications for monitoring and management. Lakes and Reservoirs: Research and Management 5(3):195-205.

Moisander, P. H., E. McClinton and H. W. Paerl. 2002. Salinity effects on growth, photosynthetic parameters, and nitrogenase activity in estuarine planktonic cyanobacteria. Microbial Ecology 43(4):432-442.

Moore, D., G. B. McGregor and G. Shaw. 2004. Morphological changes during akinete germination in *Cylindrospermopsis raciborskii* (Nostocales, Cyanobacteria). Journal of Phycology 40(6):1098-1105.

Moore, D., M. O'Donohue, C. Garnett, C. Critchley and G. Shaw. 2005. Factors affecting akinete differentiation in *Cylindrospermopsis raciborskii* (Nostocales, Cyanobacteria). Freshwater Biology 50(2):345-352.

Moore, D., M. O'Donohue, G. Shaw and C. Critchley. 2003. Potential triggers for akinete differentiation in an Australian strain of the cyanobacterium *Cylindrospermopsis raciborskii* (AWT 205/1). Hydrobiologia 506-509:175-180.

Nogueira, I. C. G., M. L. Saker, S. Pflugmacher, C. Wiegand and V. M. Vasconcelos. 2004. Toxicity of the cyanobacterium *Cylindrospermopsis raciborskii* to *Daphnia magna*. Environmental Toxicology 19(5):453-459.

Padisak, J. 2003. Estimation of minimum sedimentary inoculum (akinete) pool of *Cylindrospermopsis raciborskii*: a morphology and life-cycle based method. Hydrobiologia 502:389-394.

Ramberg, L. 1987. Phytoplankton succession in the Sanyati Basin, Lake Kariba. Hydrobiologia 153(3):193-202.

Rothhaupt, K. O. 1991. The influence of toxic and filamentous blue-green algae on feeding and population growth of the rotifer *Brachionus rubens*. Internationale Revue der Gesamten Hydrobiologie 76(1):67-72.

Saker, M. L. and B. A. Neilan. 2001. Varied diazotrophies, morphologies, and toxicities of genetically similar isolates of *Cylindrospermopsis raciborskii* (Nostocales, Cyanophyceae) from Northern Australia. Applied and Environmental Microbiology 67(4):1839-1845.

Saker, M. L. and D. J. Griffiths. 2000. The effect of temperature on growth and cylindrospermopsin content of seven isolates of *Cylindrospermopsis raciborskii* (Nostocales, Cyanophyceae) from water bodies in northern Australia. Phycologia 39(4):349-354.

Saker, M. L. and D. J. Griffiths. 2001. Occurrence of blooms of the cyanobacterium *Cylindrospermopsis raciborskii* (Woloszynska) Seenayya and Subba Raju in a north Queensland domestic water supply. Marine and Freshwater Research 52(6):907-915.

Saker, M. L. and G. K. Eaglesham. 1999. The accumulation of cylindrospermopsin from the cyanobacterium *Cylindrospermopsis raciborskii* in tissues of the redclaw crayfish *Cherax quadricarinatus*. Toxicon 37(7):1065-1077.

Saker, M. L., J. S. Metcalf, G. A. Codd and V. M. Vasconcelos. 2004. Accumulation and depuration of the cyanobacterial toxin cylindrospermopsin in the freshwater mussel *Anodonta cygnea*. Toxicon 43(2):185-194.

Saker, M. L., B. A. Neilan and D. J. Griffiths. 1999a. Two morphological forms of *Cylindrospermopsis raciborskii* (Cyanobacteria) isolated from Solomon Dam, Palm Island, Queensland. Journal of Phycology 35(3):599-606.

Saker, M. L., A. D. Thomas and J. H. Norton. 1999b. Cattle mortality attributed to the toxic cyanobacterium *Cylindrospermopsis raciborskii* in an outback region of North Queensland. Environmental Toxicology 14(1):179-182.

Schembri, M. A., B. A. Neilan and C. P. Saint. 2001. Identification of genes implicated in toxin production in the cyanobacterium *Cylindrospermopsis raciborskii*. Environmental Toxicology 16(5):413-421.

Shafik, H. M., S. Herodek, M. Presing and L. Voros. 2001. Factors affecting growth and cell composition of cyanoprokaryote *Cylindrospermopsis raciborskii* (Woloszynska) Seenayya and Subba Raju. Archiv fuer Hydrobiologie, Algological Studies 140(2p.1/4):75-93.

Shafik, H. M., L. Voros, P. Sprober, M. Presing and A. W. Kovacs. 2003. Some special morphological features of *Cylindrospermopsin raciborskii* in batch and continuous cultures. Hydrobiologia 506-509:163-167.

Shen, X., P. K. S. Lam, G. R. Shaw and W. Wickramasinghe. 2002. Genotoxicity investigation of a cyanobacterial toxin, cylindrospermopsin. Toxicon 40(10):1499-1501.

Sprober, P., H. M. Shafik, M. Presing, A. W. Kovacs and S. Herodek. 2003. Nitrogen uptake and fixation in the cyanobacterium *Cylindrospermopsis raciborskii* under different nitrogen conditions. Hydrobiologia 506-50:169-174.

Stewart, I., A. A. Seawright, P. J. Schluter and G. R. Shaw. 2006. Primary irritant and delayed-contact hypersensitivity reactions to the freshwater cyanobacterium *Cylindrospermopsis raciborskii* and its associated toxin cylindrospermopsin. Dermatology 6(5):1-12.

Taft, C. E. and C. W. Taft. 1971. Algae of Western Lake Erie. College of Biological Sciences, Ohio State University, Columbus, Ohio.

Thomas, A., M. L. Saker, J. H. Norton and R. D. Olsen. 1998. Cyanobacterium *Cylindrospermopsis raciborskii* as a probable cause of death in cattle in northern Queensland. Australian Veterinary Journal 76:592-594.

Tucci, A. and C. L. Sant'Anna. 2003. *Cylindrospermopsis raciborskii* (Woloszynska) Seenayya and Suba Raju (Cyanobacteria): weekly variation and relation with environmental factors in an eutrophic lake, Sao Paulo, SP, Brazl. Revista Brasileira de Botanica 26(1):97-112.

White, S. H., L. J. Duivenvoorden, L. D. Fabbro and G. K. Eaglesham. 2006. Influence of intracellular toxin concentrations on cylindrospermopsin bioaccumulation in a freshwater gastropod (*Melanoides tuberculata*). Toxicon 47(5):497-509.

Other Resources:

Author: Rebekah M. Kipp

Revision Date: Feb. 19, 2007

Citation for this Information: Rebekah M. Kipp. 2006. GLANSIS.

Group: Phytoplankton (cyanobacteria, or blue-green algae)

Lake(s): Lake Michigan drainage, Lake Erie

Genus: *Cylindrospermopsis*

Species: *raciborskii*

Common Name: Cylindro

Status: Established

Freshwater/Marine: Freshwater

Pathway: Unknown (possibly shipping; other possibilities include dispersal by recreational boating, and natural dispersal via waterfowl)

Exotic/Transplant: Exotic